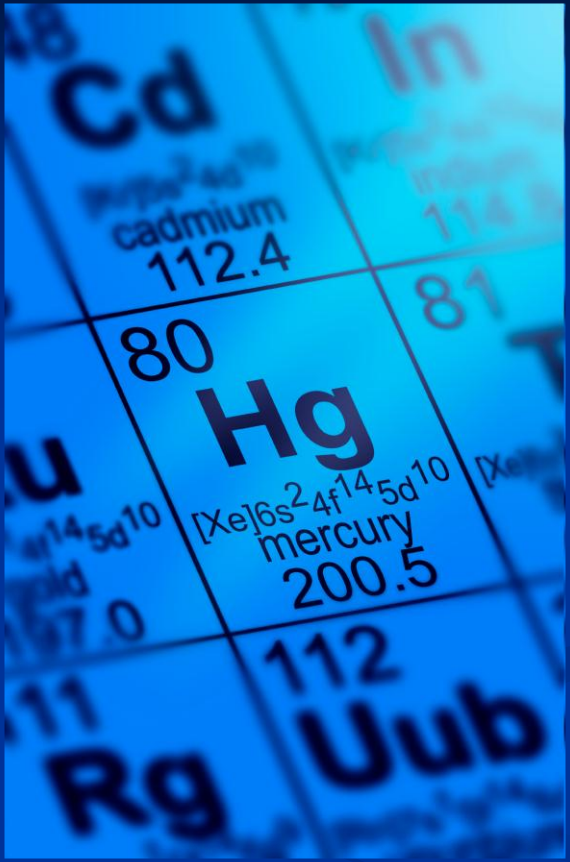
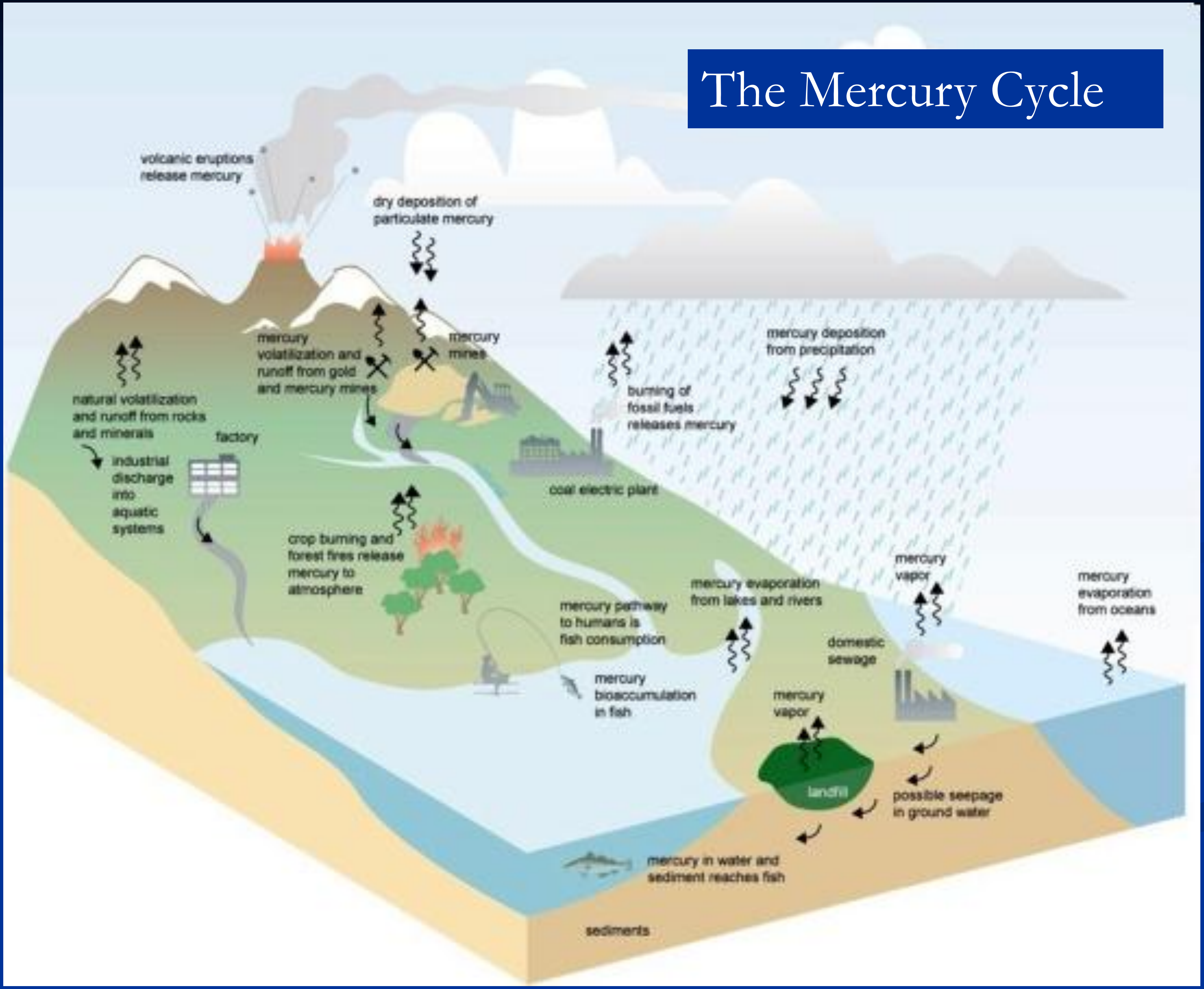
Mercury in Utah: Should you be concerned?

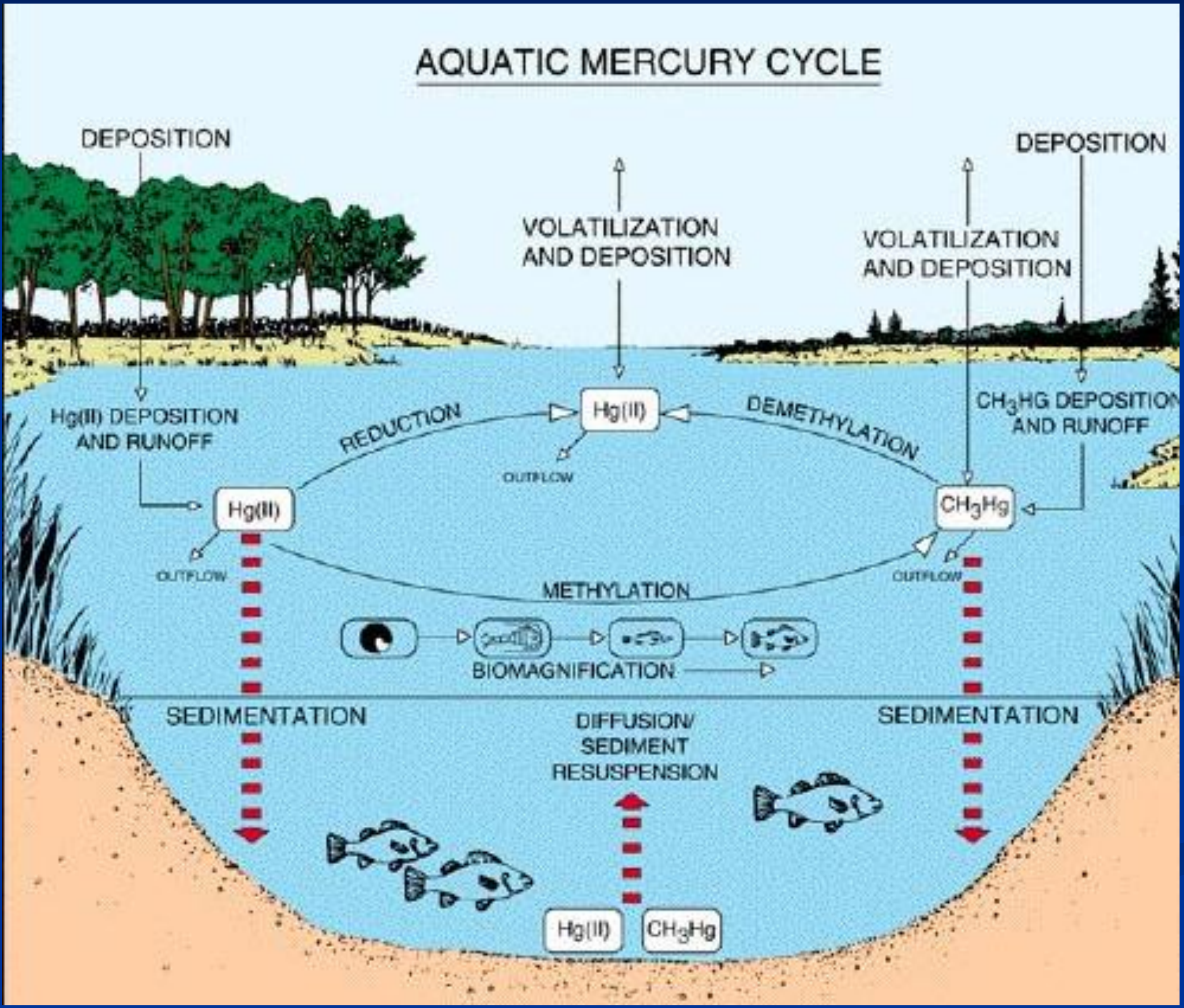


Jodi Gardberg, Great Salt Lake Watershed Coordinator and a Statewide Mercury Coordinator
Utah DEQ, Division of Water Quality

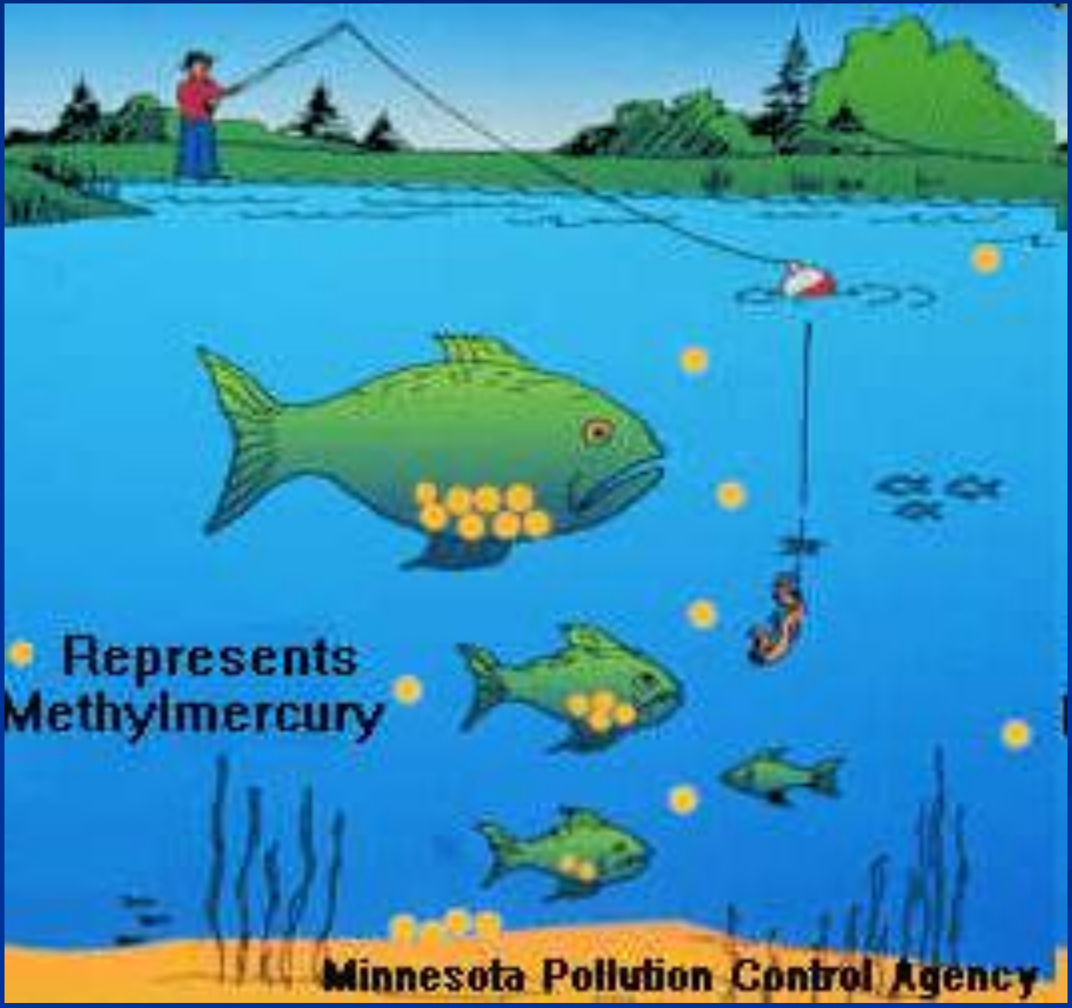
The Mercury Cycle



Mercury in Water



Bioaccumulation of Methyl Mercury (MeHg)



Toxic Effects of MeHg to Humans

- Neurotoxin
- Impacts the immune system
- Alters genetic and enzyme systems
- Particularly damaging to developing embryos

Most Vulnerable Group: Pregnant Woman, Nursing Mothers and Young Children

- Methylmercury easily passes from the mother’s bloodstream to the fetus
- Methylmercury has been found in mother’s breast milk
- Young children < 4-6 years of age:
  - Rapidly absorb nutrients, inorganics from the stomach
  - Have rapidly developing neurological systems

National Health Advisory for Women of Child-bearing Age and Young Children

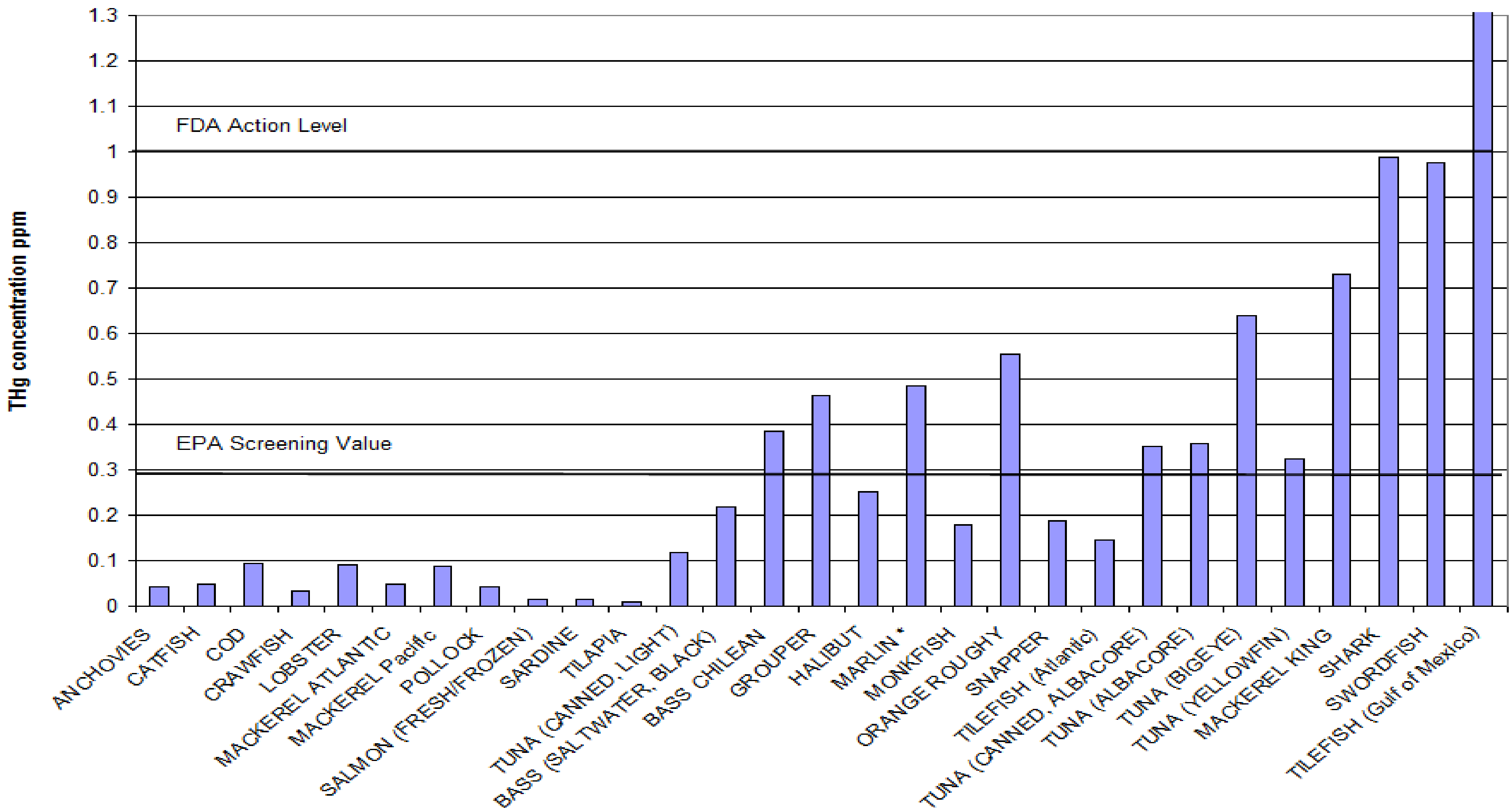
1. Do not eat swordfish, shark, king mackerel or tile fish
2. Eat up to 12 oz./week of fish that are lower in mercury: shrimp, canned light tuna, salmon, pollock and catfish. Albacore ("white") has higher levels of mercury; consume only 6 oz./week
3. If no advisory is available, eat up to 6 oz./week (1 average meal) but don't consume any other fish during that week

Environmental Protection Agency versus Food and Drug Administration

- EPA Screening Value (SV) = 0.30 mg of mercury/kg of fish tissue (mg/kg = ppm)

- FDA Action Level = 1 mg/kg or 1 ppm

FDA Mercury Levels in Commercial Fish



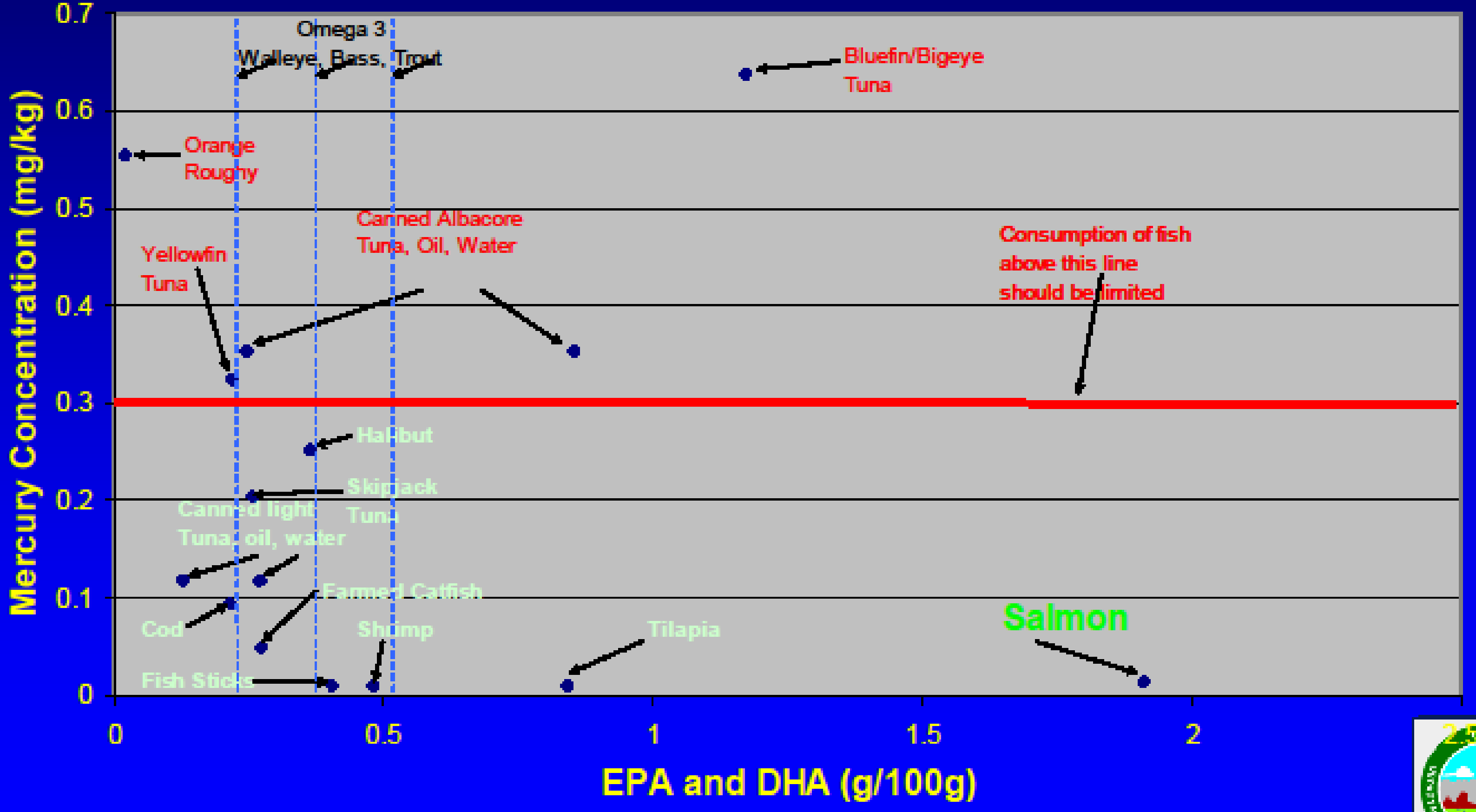
http://www.fda.gov/food/foodsafety/product-specificinformation/seafood/foodbornepathogenscontaminants/methylmercury/ucm115644.htm

Do Benefits of Eating Fish Outweigh the Risks?

- <u>Benefits of Fish Consumption</u>
  - Good source of protein, low in saturated fat
  - Contains Omega 3 Fatty Acids – great for the heart
  - AHA recommends eating 2 servings (3.5 oz) per week
  - AHA recommends patients with CHD to consume 1000 mg/day of EPA (**eicosapentaenoic acid)** plus DHA (**docosahexaenoic acid)**, the main components of fish oils.
  - DHA is beneficial for fetal and early childhood neurodevelopment

- <u>Risks of Fish Consumption</u>
  - Toxicity issues

EPA and DHA (Omega 3 Fatty Acids) vs Mercury Content



Eat Fish, Choose Wisely

Utah Fish Consumption Advisories

For more information:

www.fishadvisories.utah.gov

Utah DNR Wildlife Resources
801-538-4700

Utah Department of Health
801-538-6191

Utah Department of Environmental Quality
801-536-4400

Utah Fish Advisories

38 lb Striper from Lake Powell (Hg concentration 1.01 ppm)

Mercury Advisory Process

- Collect fish and or waterfowl (DWR - Division of Wildlife Resources & DWQ - Division of Water Quality)
- Laboratory preparation and analysis (EPA)
- Assure adequacy of data set (DWQ)
- Human health assessment (DOH - Department of Health)
- Coordination with DOH, DWR and DWQ
- Joint Advisory Issued

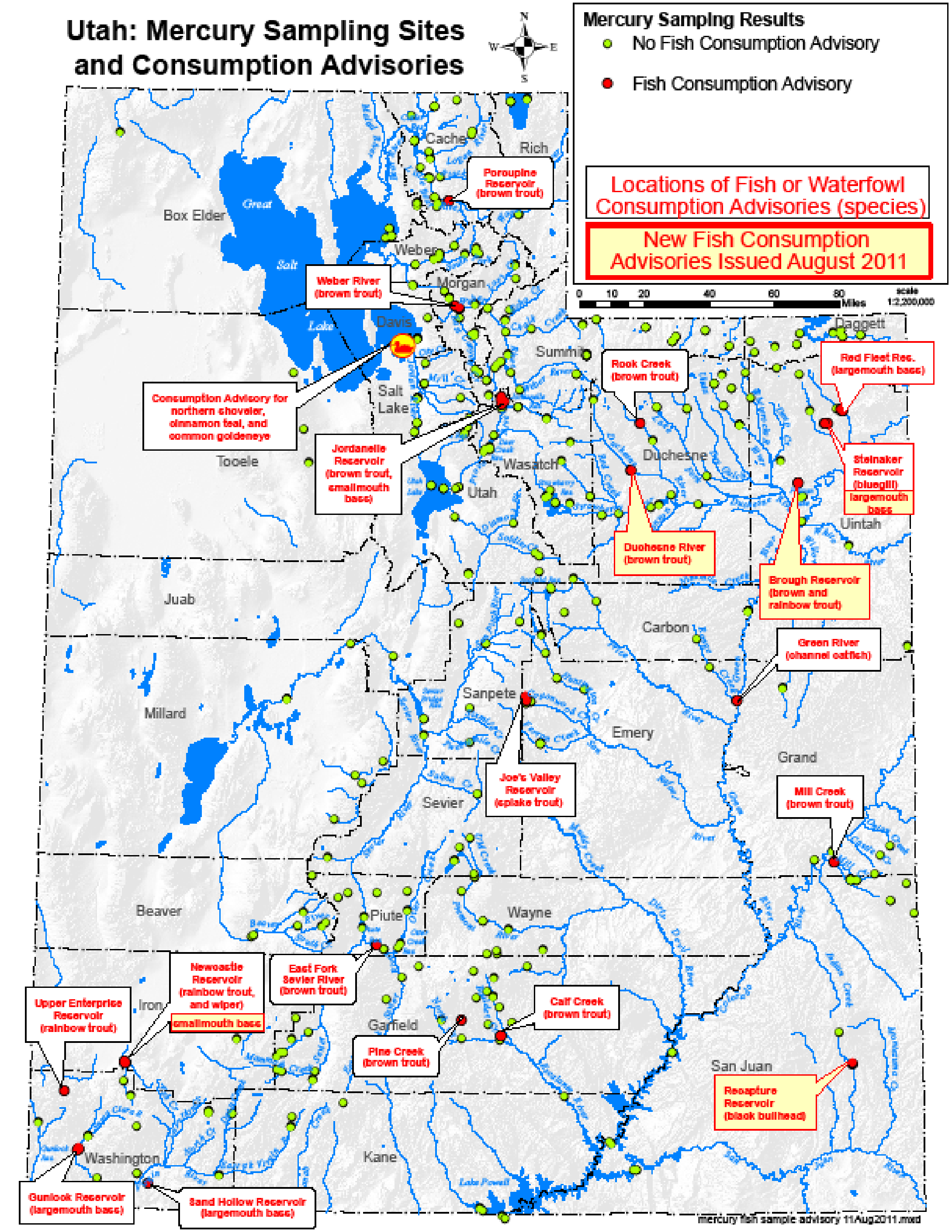
Total Fish Sampled = 2566 fish

Total Sites Visited = 322 sites

River Sites = 200

Lake/Reservoir Sites = 122

Number of Species = 35



Mercury Sampling Sites and Consumption Advisories Map

18 Locations

River Sites = 8

Lake/Reservoir Sites = 11

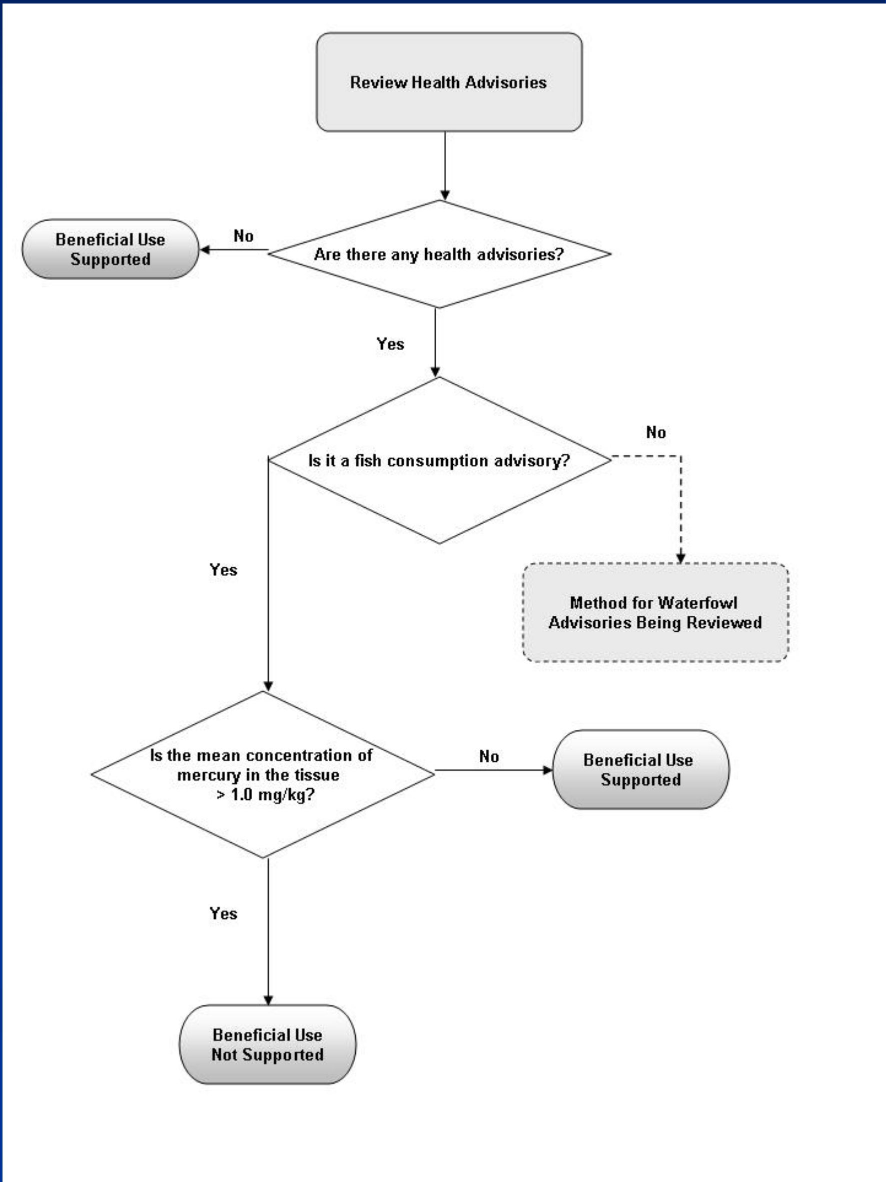
www.fishadvisories.utah.gov/

Mercury Hotspot – Southwestern Utah
EPA Screening Value = 0.3 ppm

Location	Year	Species	Pregnant Woman and Children (4 oz meal/month)	Adult (8 oz meal/month)	Mean Mercury concentration (ppm)
Newcastle Reservoir	2006 2008 2011	Rainbow Trout Wiper (>2 lbs) Smallmouth Bass	Do Not Eat Do Not Eat Do Not Eat	1 serving Do Not Eat 1 serving	0.48 1.40
Upper Enterprise Reservoir	2006	Rainbow Trout	Do Not Eat	1 serving	0.66
Gunlock Reservoir	2005	Largemouth Bass	1 serving	2 servings	0.42
Sand Hollow Reservoir	2007	Largemouth Bass	Do Not Eat	2 servings	0.41

New Castle Reservoir – Impaired

- Listed as Impaired on the 303 (d) list
- Beneficial Use Not Supported
  - Fish consumption advisory for mercury is in place and fish tissue mercury concentration is greater than (>) 1.0 mg/kg.



Using thermocline manipulation to restore mercury-contaminated reservoirs in southwestern Utah

UTAH DIVISION OF Wildlife Resources

USGS science for a changing world

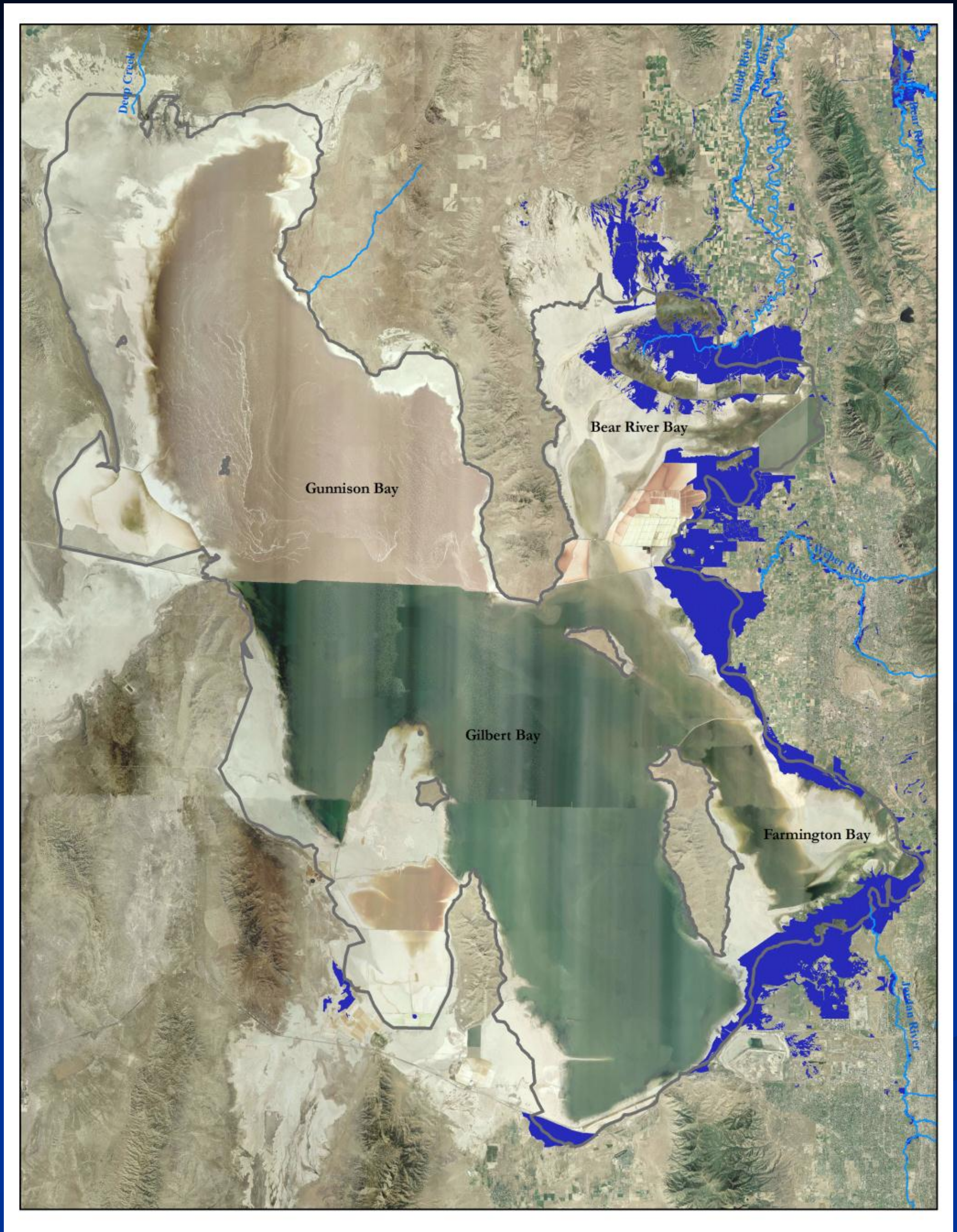
UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

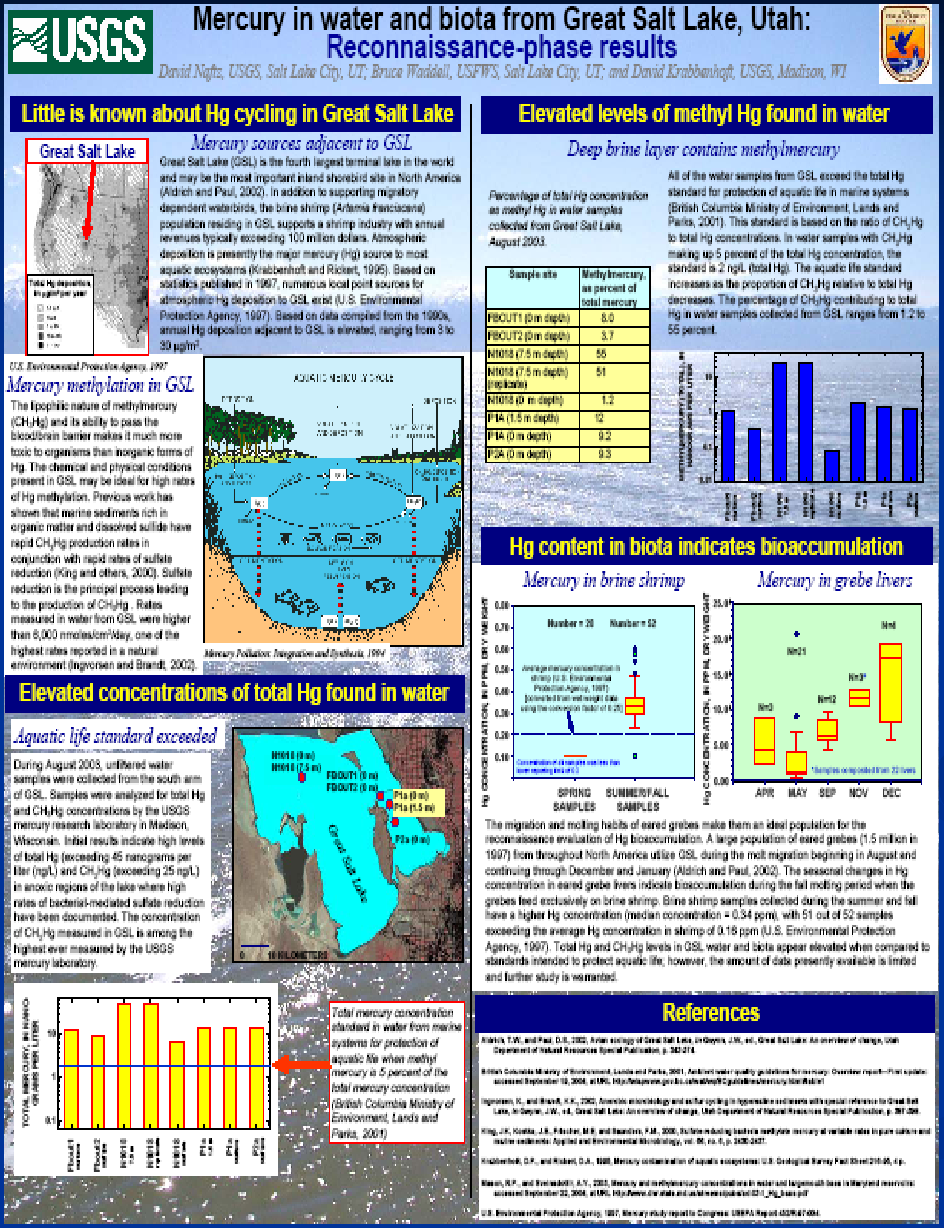
2008 Mercury Ecosystem Assessment of Great Salt Lake

photo - Charles Uibel - greatsaltlakephotos.com

Great Salt Lake

- ❑ Fourth largest terminal lake in the world
- ❑ Typically 3 to 5 times saltier than the ocean
- ❑ Supports 7.5 million birds annually and is part of the Western Hemisphere Shorebird Reserve Network
- ❑ 80% (427,000 acres) of Utah’s Wetlands reside along Great Salt Lake





In 2003, USGS measured some of the highest levels of Hg found in U.S. surface waters

Waterfowl Advisories

Northern Shoveler

Average 3.22 ppm THg

Common Goldeneye

Average 2.01 ppm THg

Cinnamon Teal

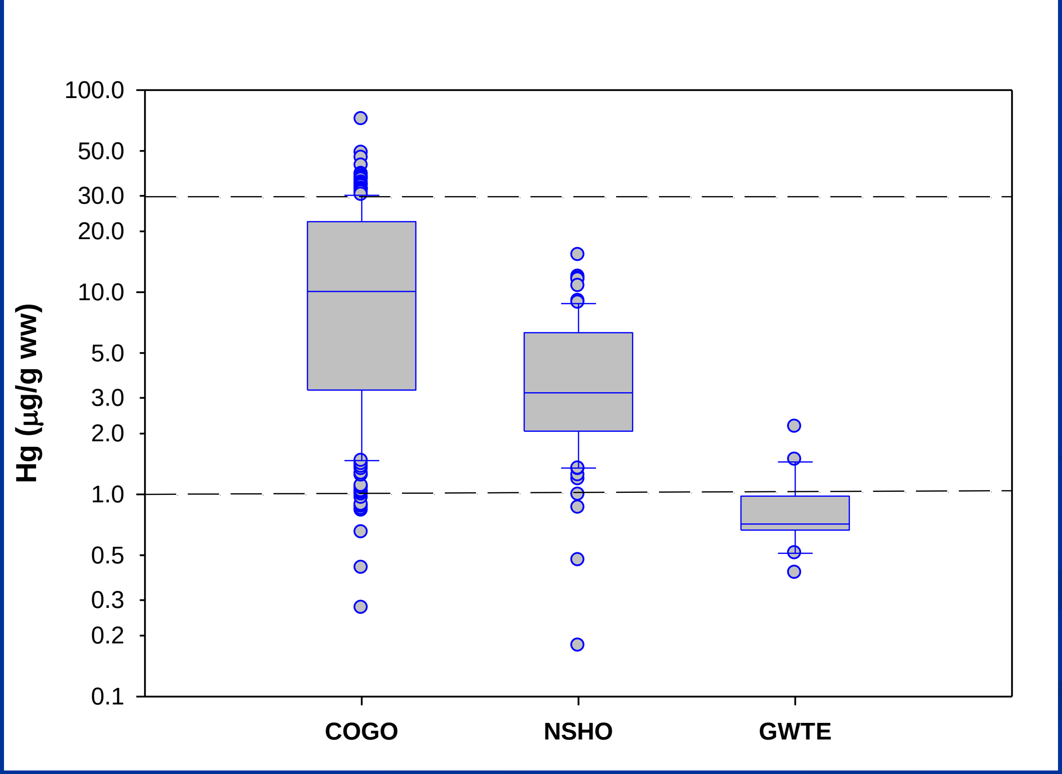
Average 0.42 ppm THg

Adults should not eat more that 1 8 oz meal per month and pregnant women and children should not eat at all

www.waterfowladvisories.utah.gov/advisories.htm

Mercury in Wintering Waterfowl

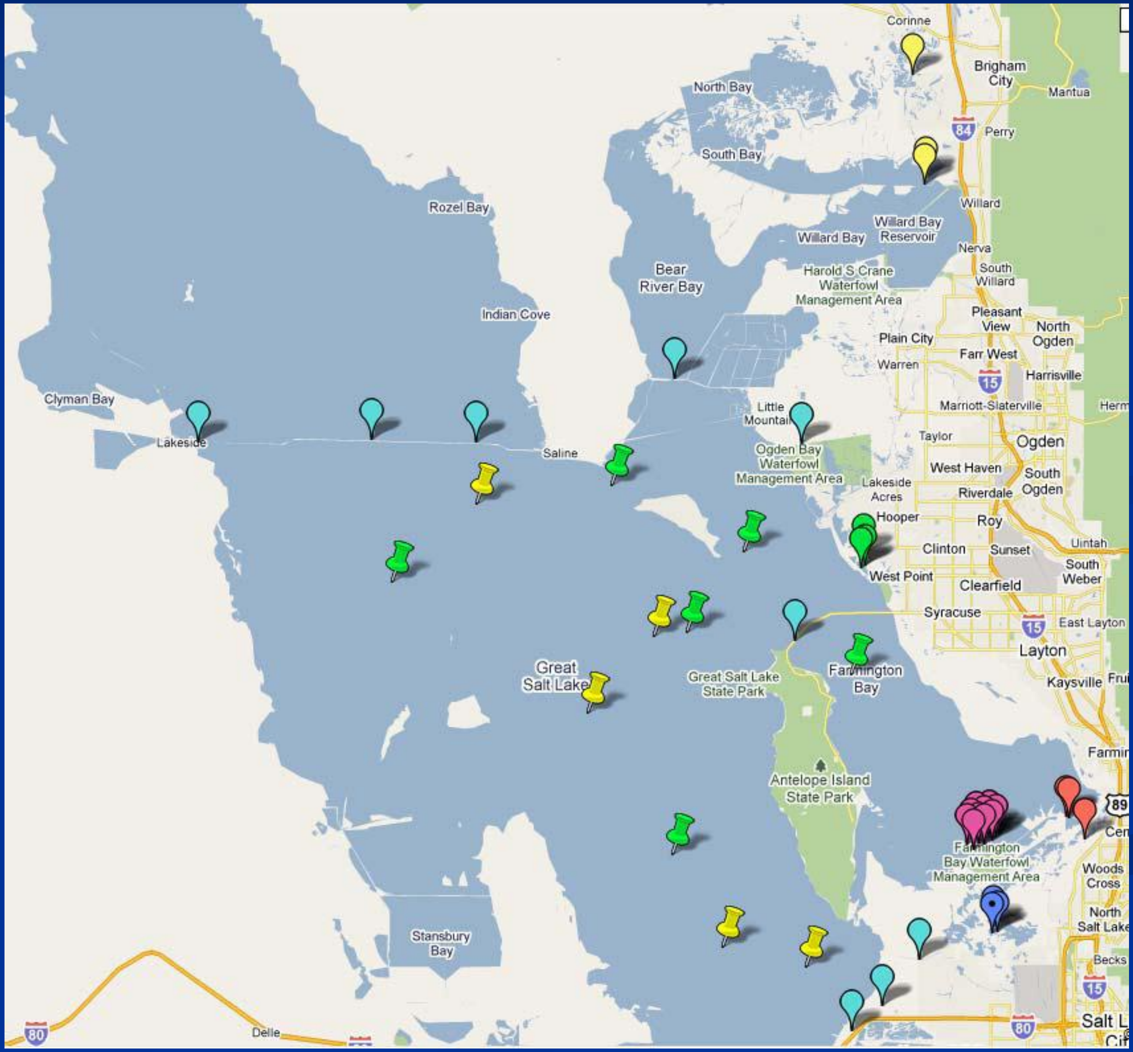
J. L. Vest, Utah State University
M. R. Conover, Utah State University
C. Perschon, Utah Division of Wildlife Resources
J. Luft, Utah Division of Wildlife Resources



Mercury in the Water Column and Sediment

Dave Naftz, US Geological Survey

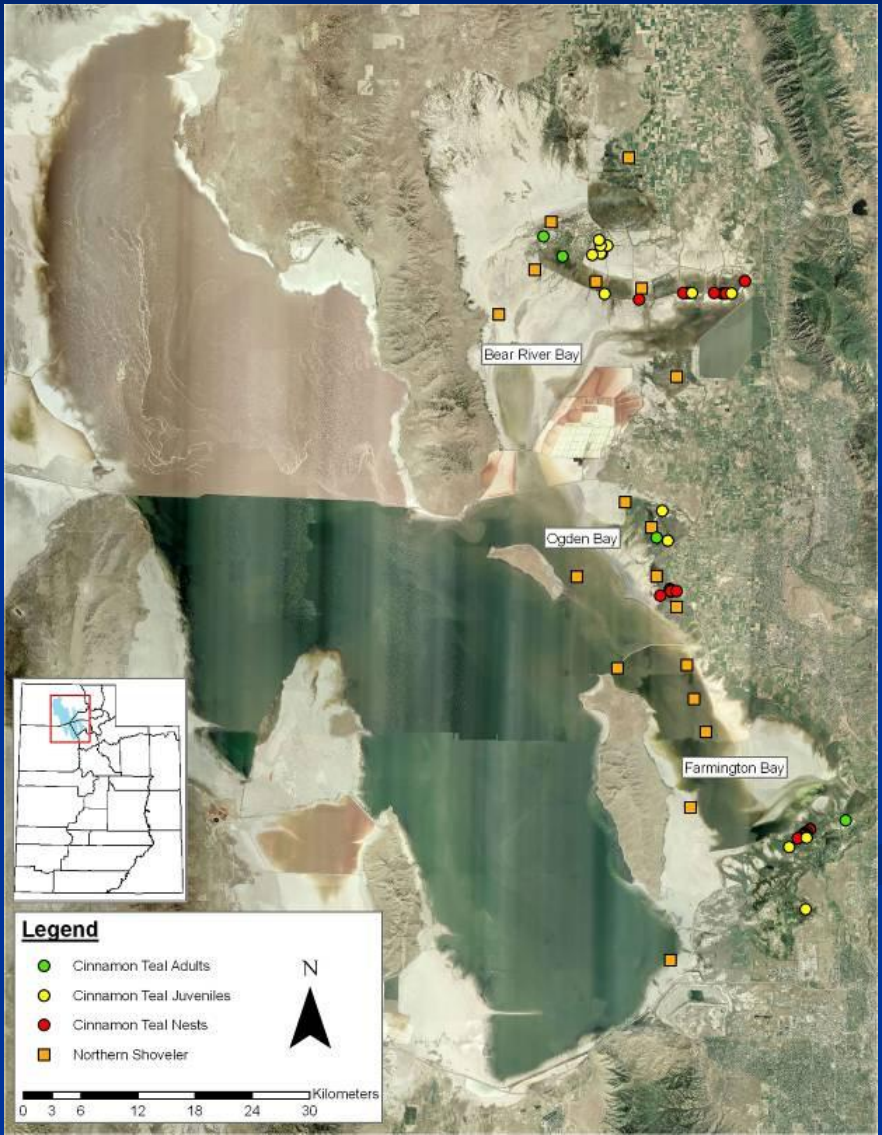
- THg water column
  - Total: 48 samples
    - Shallow brine: 36 samples
    - Deep brine: 12 samples
- THg sediment 58 samples



Mercury in the Avian Species

John Neil, Great Salt Lake Ecosystems Project, Division of Wildlife Resources
Chris Cline, US Fish and Wildlife Service

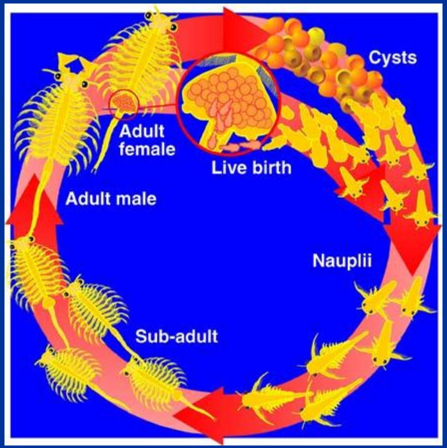
- THg and meHg in Cinnamon Teal
  - Eggs – 30 samples (10 from each bay)
  - Juveniles – 21 samples
  - Adults – 29 samples
- THg and meHg in Northern Shovelers
  - Adults – 48 samples

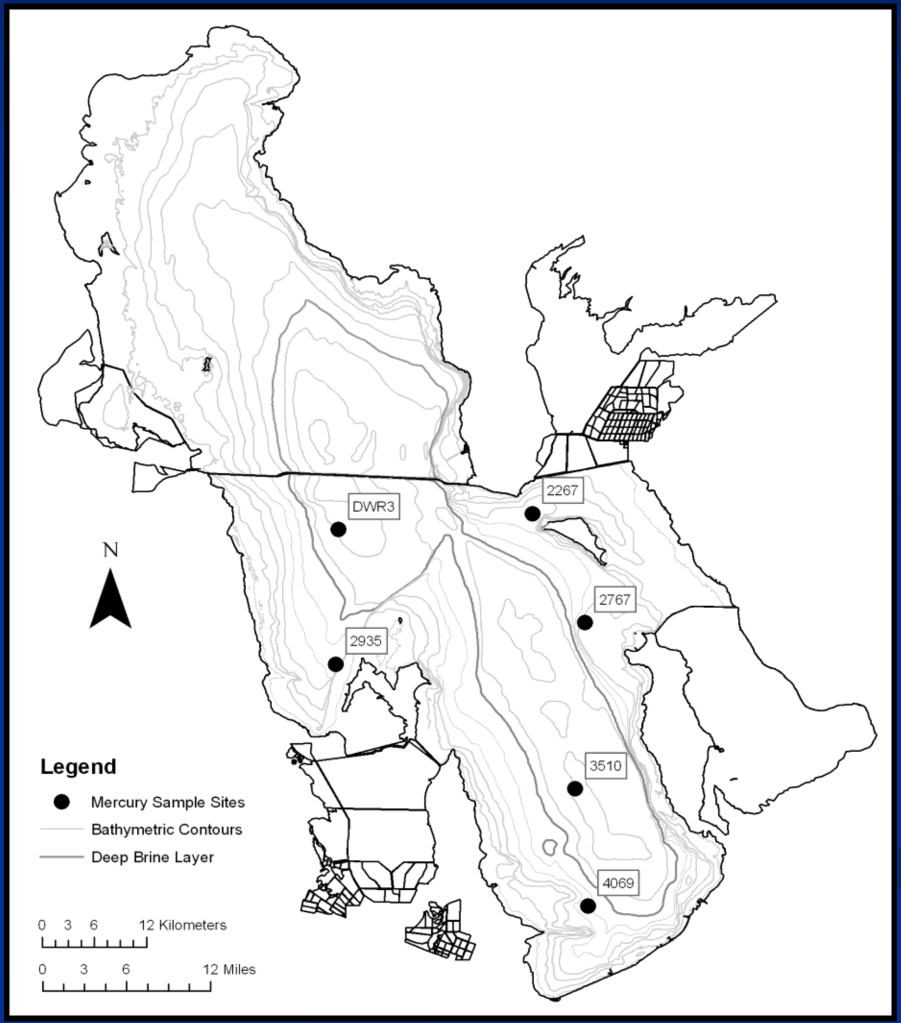


Mercury in the Avian Diet

Jim Van Leuwen and Phil Brown, Great Salt Lake Ecosystems Project, Division of Wildlife Resources

- THg in Brine Shrimp
  - Adults: 60 samples
  - Cysts and Nauplii: 56 samples
  - Cysts from streaks: 26 samples

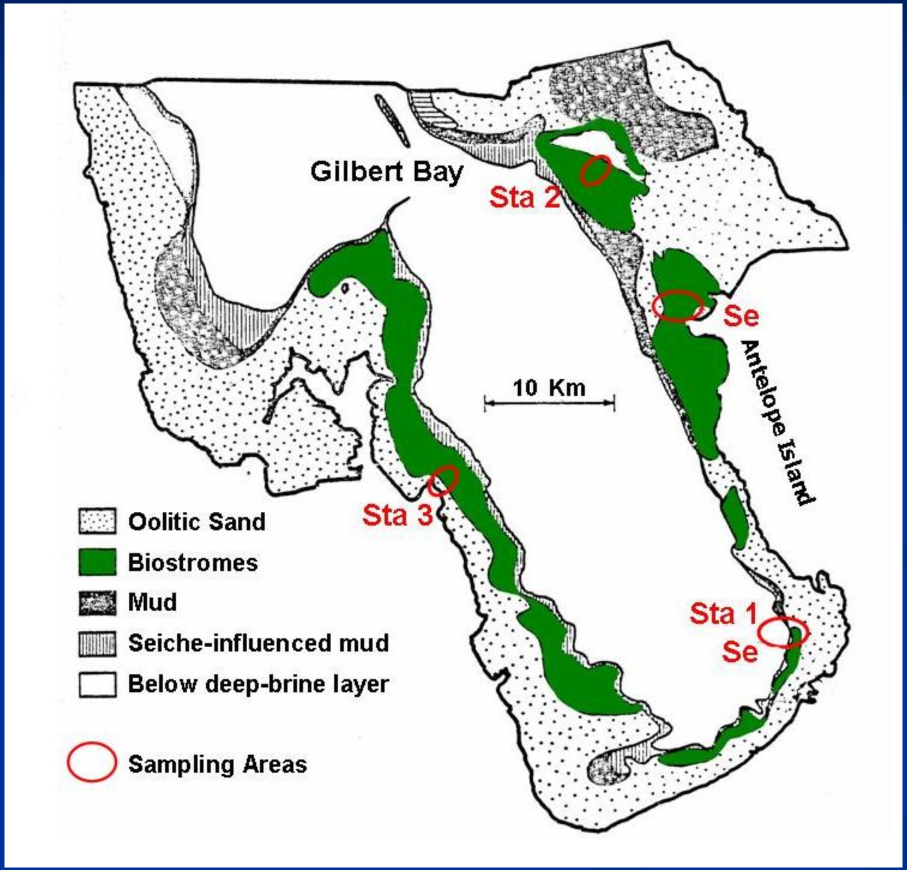




Mercury in the Avian Diet

Wayne Wurtsbaugh, Utah State University

- THg in Brine Fly
  - Larve – 32 samples
  - Pupae – 15 samples
  - Adult – 10 samples
- THg in the Periphyton
  - 69 samples



Mercury in the Water column and sediments of GSL Wetlands (Farmington Bay, Ogden Bay and Bear River Bay)

Dave Naftz, US Geological Survey

- THg in the Water Column: 47 samples
- THg in the Sediments: 37 samples

Literature Benchmarks

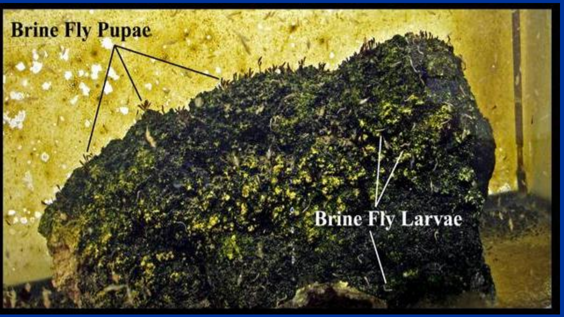
- US EPA Aquatic Life Criteria for THg in Marine Waters = 25 ng/L
- Washington State Marine Sediment THg Standard: 410 ng/g
- US EPA Screening Value for Consumption = 0.3 THg ppm ww
- Evers Dietary Exposure Risk Ranges:
  - Low Risk in Diet < 0.05 mHg ppm (ww)
  - Moderate Risk in Diet 0.05 – 0.15 mHg ppm (ww)
  - High Risk in Diet 0.15 – 0.3 mHg1 ppm (ww)
  - Extra High Risk in Diet >0.3 mHg1 ppm (ww)
- Avian Liver Risk Ranges:
  - Low Risk < 0.89 mHg ppm (ww)
  - Moderate Risk 0.89 – 2.00 mHg ppm (ww)
  - High Risk 2.00 – 6.00 mHg1 ppm (ww)
  - Extra High Risk > 6.00 mHg1 ppm (ww)

Great Salt Lake Simplified Food Web (open waters)

Birds

Brine Fly (larvae, pupae and adults

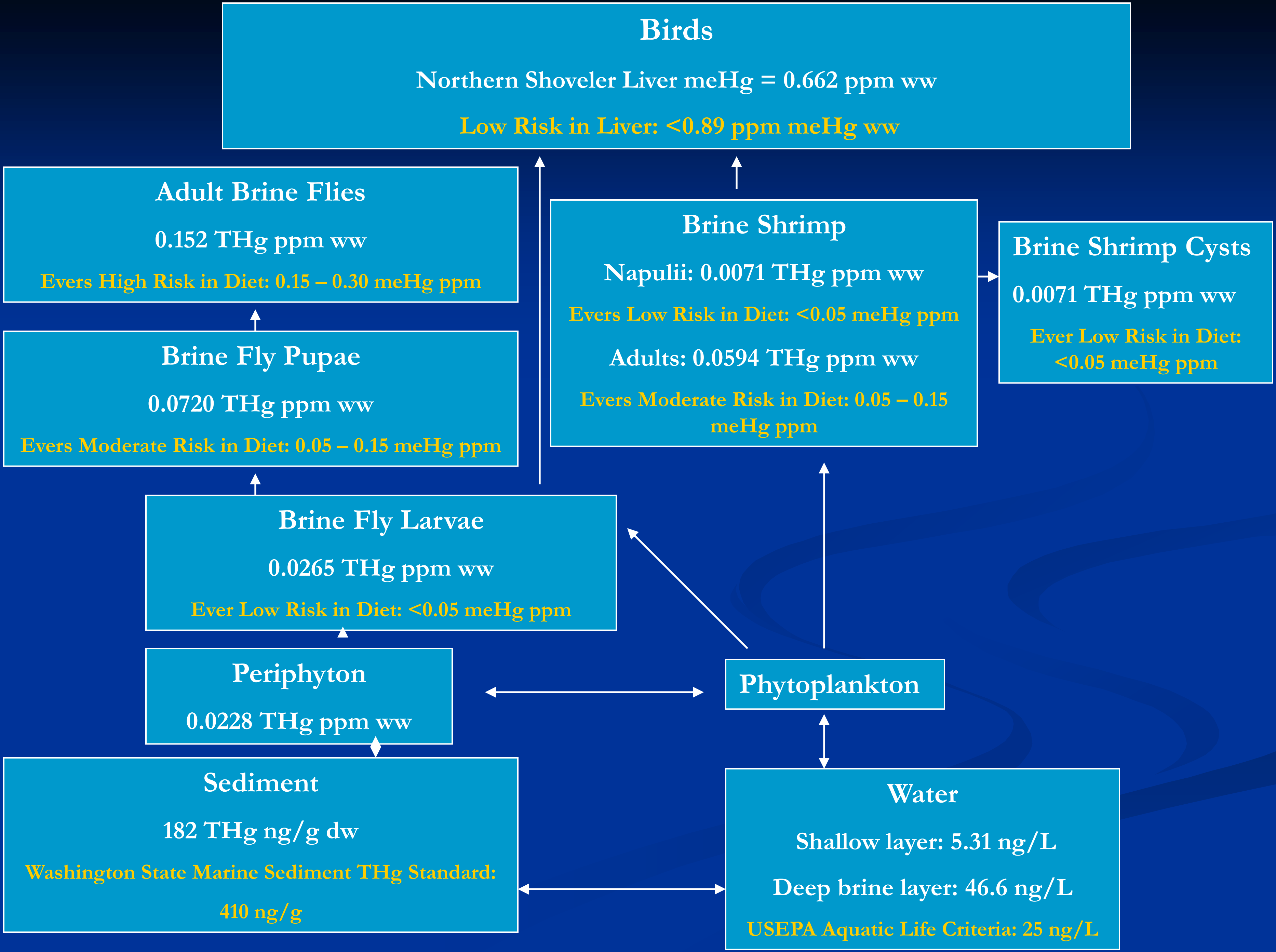
Brine Shrimp (cysts, nauplii and adults)



Periphyton

Phytoplankton

Sediment ⟷ Water (deep brine and shallow layers)



Birds
Northern Shoveler Liver meHg = 0.662 ppm ww
Low Risk in Liver: <0.89 ppm meHg ww
Adult Brine Flies
0.152 THg ppm ww
Evers High Risk in Diet: 0.15 – 0.30 meHg ppm
Brine Shrimp
Napulii: 0.0071 THg ppm ww
Evers Low Risk in Diet: <0.05 meHg ppm
Adults: 0.0594 THg ppm ww
Evers Moderate Risk in Diet: 0.05 – 0.15 meHg ppm
Brine Shrimp Cysts
0.0071 THg ppm ww
Ever Low Risk in Diet: <0.05 meHg ppm
Brine Fly Pupae
0.0720 THg ppm ww
Evers Moderate Risk in Diet: 0.05 – 0.15 meHg ppm
Brine Fly Larvae
0.0265 THg ppm ww
Ever Low Risk in Diet: <0.05 meHg ppm
Periphyton
0.0228 THg ppm ww
Phytoplankton
Sediment
182 THg ng/g dw
Washington State Marine Sediment THg Standard: 410 ng/g
Water
Shallow layer: 5.31 ng/L
Deep brine layer: 46.6 ng/L
USEPA Aquatic Life Criteria: 25 ng/L

Human Health Considerations

- EPA Screening Value = 0.3 mg of mercury/kg of fresh muscle tissue weight (ppm) ww

Species	2005 MeHg pp ww	2008 MeHg pp ww
Cinnamon Teal	0.42	0.163
Northern Shoveler	3.22	0.207

- Brine Shrimp Cysts mean MeHg = 0.0071 ppm ww

Utah Statewide Mercury Work Group Members

Organization	Representative
Anglers Group	Paul Dremann
Duck Club	Bruce Waddell
Environmental Organization	Maunsel Pearce
Power Generating Industry	James Campbell
Mining Representative	Tod Bingham
Department of Health	Christina McNaughton
Division of Wildlife Resources	Walt Donaldson
Division of Air Quality	Steve Packham
Division of Environmental Response & Remediation	Scott Everett
Dept. of Agriculture	Mark Martin
Division of Water Quality	John Whitehead
Local Health Department	Kevin Ockleberry
US Fish & Wildlife Service	Christine Cline
US Geological Survey	David Naftz
EPA Region 8	Jim Berkley
Great Salt Lakekeeper	Jeff Salt
Utah Medical Association	Jane Bowman
University of Utah	Bill Johnson
Tribal Interests	Jason Walker

Please Visit!

www.mercury.utah.gov

Advisories & Health

- Fish Consumption Advisories
- Health Effects
- Map of Local Health Departments
- Mercury Toxicity
- Moms & Kids
  - EPA's Fish Kids
  - Eat Fish, Choose Wisely Presentation
  - Sensitive Populations
- Utah Waterways Advisory Map
- Waterfowl Advisories

Mercury Facts

- In the Environment
  - Bioaccumulation
  - Mercury in Fish and Wildlife
- Mercury Information
  - Atmospheric Transport
  - Background
  - Biogeochemistry
  - Global Mercury Budget
  - Sources
- Spills and Proper Disposal
  - Disposal and Recycling
  - Mercury in Products
  - Mercury Spills

Mercury in Utah

- Get the Mercury Out!
- Healthy Hospitals Initiative
- Utah Information

Mercury Workgroup

- Mercury Work Group home page
- Process
- Email Listserv
- Workgroup Members

Great Salt Lake Simplified Food Web (impounded wetlands)

Birds

Submerged Aquatic Vegetation

Macroinvertebrates

Phytoplankton

Sediment ⟷ Water

Bear River Bay Wetlands

Birds

Cinnamon Teal Liver meHg =0.205 ppm ww

Low Risk in Liver: <0.89 ppm ww

Cinnamon Teal Eggs meHg = 0.133 ppm ww

Low Risk in Eggs: <0.5 ppm ww

Macro invertebrates

SAV

Phytoplankton

Sediment

17.38 ng/g

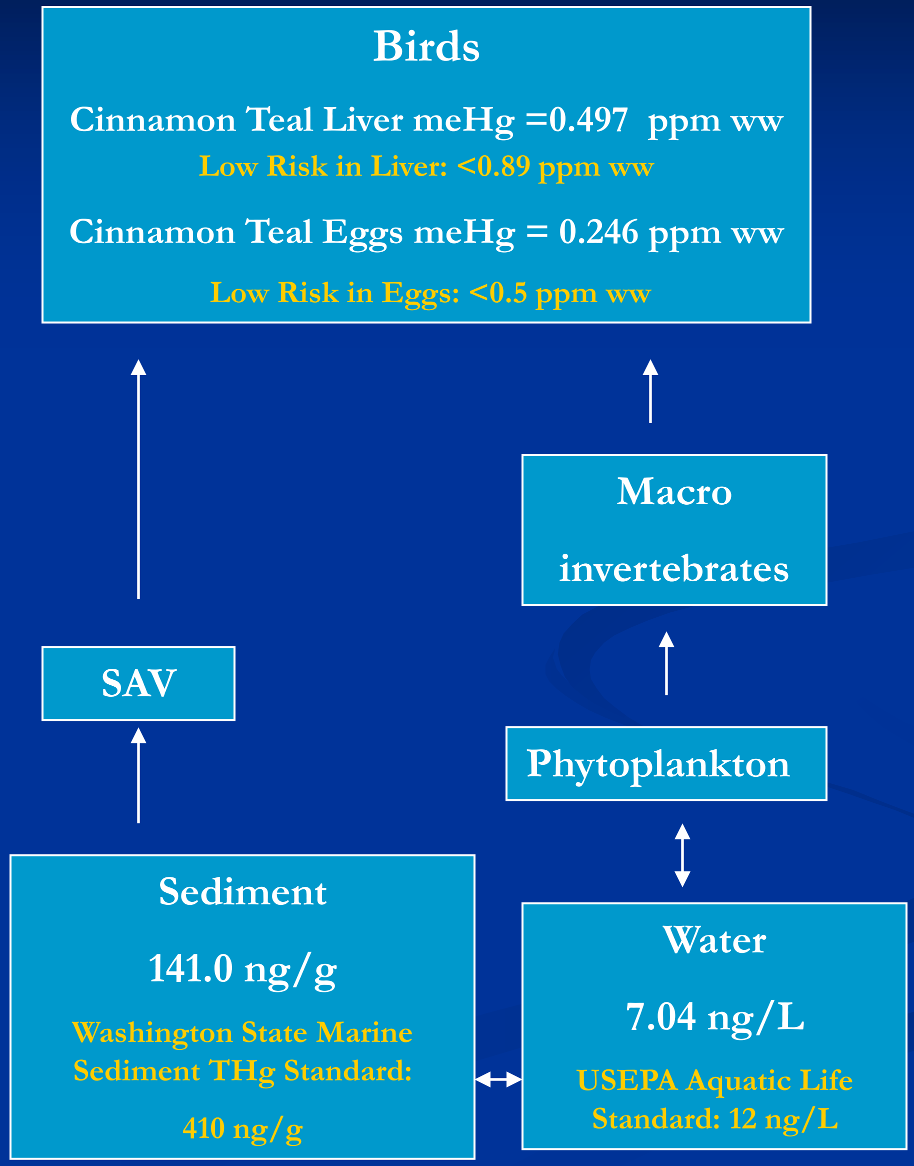
Washington State Marine Sediment THg Standard: 410 ng/g

Water

2.93 ng/L

USEPA Aquatic Life Standard: 12 ng/L

Ogden Bay Wetlands



Farmington Bay Wetlands

Birds

Cinnamon Teal Liver meHg =0.452 ppm ww

Low Risk in Liver: <0.89 ppm ww

Cinnamon Teal Eggs meHg = 0.135 ppm ww

Low Risk in Eggs: <0.5 ppm ww

SAV

Macro invertebrates

Phytoplankton

Sediment

FB Wildlife Mgmt Area 47.6 ng/g

Ambassador Duck Club 79.0 ng/g

Oil Drain Outfall 838.0 ng/g

Washington State Marine Sediment THg Standard: 410 ng/g

Water

FB Wildlife Mgmt Area 7.43 ng/L

Ambassador Duck Club 4.26 ng/L

USEPA Aquatic Life Standard: 12 ng/L

Next steps

- Conduct research on Hg concentrations in the parts of the food chain that weren't part of this or other assessments (e.g. periphyton and algae)
- More Hg research on those avian species that feed primarily on brine shrimp and brine flies
- More Hg research on whether the avian species are exposed to Hg at the GSL or elsewhere
- Laboratory round robin to confirm and compare results
- Research on relationship between selenium and mercury
- Perform an Eco risk assessment